Small Business Innovation Research/Small Business Tech Transfer

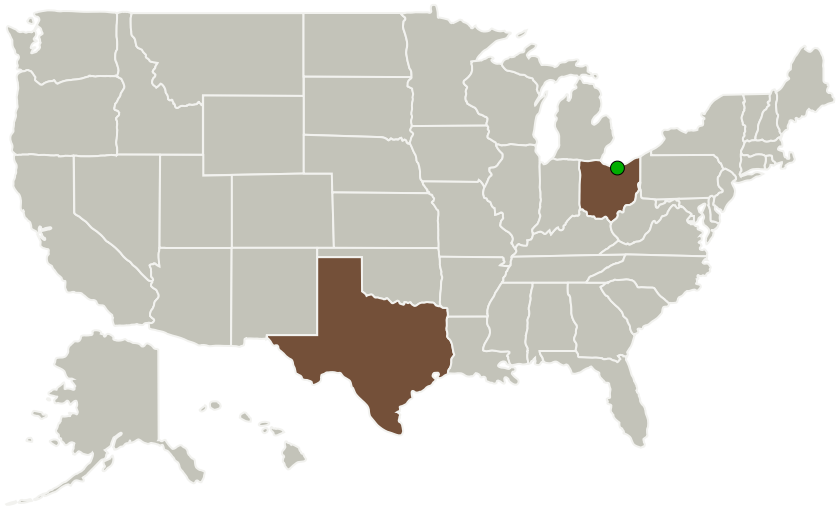
An Advanced Anode Electrocatalysis Concept for Direct Methane SOFC Systems, Phase I

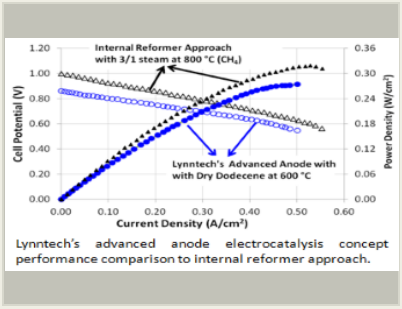
Completed Technology Project (2016 - 2016)

Project Introduction

Planned Mars missions require long duration stays in orbit or at planet's surface, cannot rely on availability of pure reactant for power generation, and necessitate sun-independent operation capability. Direct methane solid oxide fuel cell (DM-SOFC) technology with an internal reforming approach has been investigated for generation of electric power from methane in order to preserve mission flexibility. Current internal reformer catalyst uses a significant amount of water (or oxygen) in the fuel stream to eliminate carbon coking issue. Lynntech proposes an advanced anode catalysis concept for DM-SOFC that is free of carbon coking without the use of water (or oxygen) in the fuel stream. Preliminary results with Lynntech's advanced anode catalysis concept using 100% dry hydrocarbon fuels demonstrated similar power densities to direct internal reforming technology. In Phase I, Lynntech will further optimize the anode electrocatalyst component and architecture, demonstrate the performance improvements and durability with single cells running on dry methane, and built and operate a bipolar short stack. In Phase II, Lynntech will built a bipolar 3-kW DM-SOFC stack and integrate all of the balance of plant component, demonstrate its performance and durability with improved thermal cycling (using dry methane), and deliver it to NASA for further testing.

Primary U.S. Work Locations and Key Partners





Lynntech's advanced anode electrocatalysis concept performance comparison to internal reformer approach.

An Advanced Anode Electrocatalysis Concept for Direct Methane SOFC Systems, Phase I

Table of Contents

Project Introduction	1
Primary U.S. Work Locations and Key Partners	1
Project Transitions	2
Images	2
Organizational Responsibility	2
Project Management	2
Technology Maturity (TRL)	2
Technology Areas	3
Target Destinations	3

Small Business Innovation Research/Small Business Tech Transfer

An Advanced Anode Electrocatalysis Concept for Direct Methane SOFC Systems, Phase I

Completed Technology Project (2016 - 2016)

Organizations Performing Work	Role	Type	Location
Lynntech, Inc.	Lead Organization	Industry	College Station, Texas
Glenn Research Center(GRC)	Supporting Organization	NASA Center	Cleveland, Ohio

Primary U.S. Work Locations	
Ohio	Texas

Project Transitions

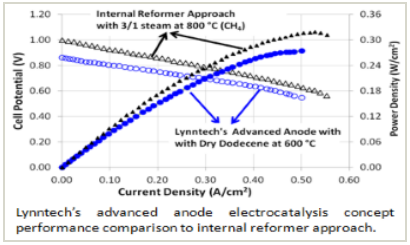
June 2016: Project Start

December 2016: Closed out

Closeout Documentation:

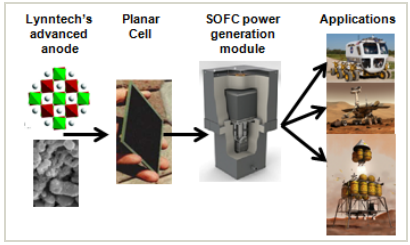
- Final Summary Chart*(https://techport.nasa.gov/file/139897)*

Images



Lynntech's advanced anode electrocatalysis concept performance comparison to internal reformer approach.

Briefing Chart Image
An Advanced Anode Electrocatalysis Concept for Direct Methane SOFC Systems, Phase I
(https://techport.nasa.gov/image/133264)



Final Summary Chart Image
An Advanced Anode Electrocatalysis Concept for Direct Methane SOFC Systems, Phase I Project Image
(https://techport.nasa.gov/image/128715)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Lynntech, Inc.

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

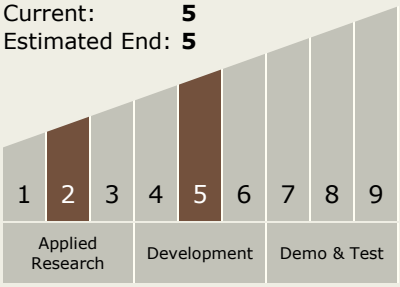
Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Mahesh Waje

Technology Maturity (TRL)

Start: **2**
Current: **5**
Estimated End: **5**



An Advanced Anode Electrocatalysis Concept for Direct Methane SOFC Systems, Phase I

Completed Technology Project (2016 - 2016)

Technology Areas

Primary:

- TX03 Aerospace Power and Energy Storage
  - TX03.1 Power Generation and Energy Conversion
    - TX03.1.4 Dynamic Energy Conversion

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System